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BUREAU OF MINES
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NONMETALLIC MINERAL INDUSTRIES IN 1939

BY

PAUL M. TYLER AND OLIVER BOWLES

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NONMETALLIC MINERAL INDUSTRIES IN 1939 1/

By Paul M. Tyler 2/ and Oliver Bowles 3/

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BACKGROUND

In 1939, American industry got off to a poor start, slowed down further during the first quarter, quickened after May, speeded up still more when war broke out again in Europe, and ended the year at a pace close to an all-time record. The average index of general business activity for the entire year (105) was well ahead of that for 1938 (86), failed to equal that of 1937 (110), and fell behind the average for 1929 (119) by a wide margin. (Federal Reserve Bank yearly indexes in parentheses).

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In view of the 7-percent increase in the number of consumers of goods and services in the United States during the past decade, the 14-point decline in general industrial production is disappointing, and employment conditions still leave much to be desired. Nevertheless, were it not for the alarming events abroad, the prospect for the new decade would be brighter than it was at the beginning of the 1930's. Furthermore, it is encouraging to find that the "impact of war" produced no serious dislocation of American business. Except for a brief flurry in September, prices of most commodities pursued an amazingly uniform course. The inventory situation is always subject to guesswork, owing to meager statistics. It is doubtful whether all the speeding up in production has been absorbed in consumption, but stocks in producers' hands are not excessive - in some instances even subnormal - and it is reasonable to suppose that inventories have been built up all along the line and that the principal gains are in positions closer to the consumer.

Many of the nonmetallic mineral industries fared much better than other business in 1939. This was due partly to displacement of competiti materials but chiefly to the fact that certain consuming industries have grown rapidly since 1929. Even during the depression years the productio of paper, glass containers, chemicals, rubber goods, and certain electrical appliances and equipment increased. The steel industry, largest mmarket for refractories and fluxing materials, produced steel at a greater rate during the last quarter of 1939 than ever before in its history, but its total output for the 12 months (42,765,699 gross tons), although 65 percent greater than in 1938, was far below its 1929 record, falling short even of its 1937 mark. Operating rates averaged 54.5 percent during the first quarter, 50.8 in the second, 62.2 in the third, and 91.2 in the fourth; the turning point was in May. Hourly earnings of steel workers, averaging 84 cents, topped those of any previous year, and were 30 percent higher in 1939 than a decade ago.

The construction industry, though far behind the $6,000,000,000 records of the late 1920's, improved in 1939 by an estimated 160 percent compared with the low point of the last 10 years, and year-end carryovers of uncompleted building permits promise that 1940 will mark the seventh consecutive advance from the 1933 bottom. The estimated value of building contracts for 37 Eastern States, according to the F. W. Dodge Corporation, was $3,355,000,000 compared with $3,196,900,000 in 1938 and all-time peak of $6,628,800,000 in 1928. Residential building was the biggest contributor to last year's increase. Of the $1,340,000,000 total under this classification, $905,000,000 came from new one- and two-family houses and $420,000,000 from apartment houses. The volume gain was 35 percent. According to estimates of the Federal Housing Administration, 450,000 nonfarm dwelling units were constructed compared with 347,000 in 1938. According to the Dodge data, nonresident projects declined 11 percent, and public works and utilities were off 7 percent from the 1938 total. The net gain for all construction, however, was 5 percent.

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In striking contrast to building and most of the heavy industries is the tremendous advance in process industries producing consumption goods. Much of the chemical industry of today scarcely existed a decade ago; instead of simply furnishing fertilizers, industrial chemicals, and processing materials it is now providing new raw materials for industry in the form of textile fibers, plastics, synthetic rubber, artificial leather, felt, and other commodities that are better and sometimes cheaper than competitive products. In the race for markets only the more efficient industries survive. The processing of industrial minerals lagged behind the processing of metallic minerals a decade ago but is rapidly catching up with and slowly, at a few fronts, running ahead of the general technologic procession. Froth flotation and agglomerate tabling are newcomers in the field of beneficiating nonmetallic minerals, but now it can be said truthfully that all the arts of the metallurgist have been summoned to the aid of producers of industrial minerals, and pioneer research has been directed toward utilization of entirely new principles. Better technology has improved the quality of many products and has justified the use of lower-grade deposits. Particle-size control and bleaching, as well as strictly purification processes, are becoming important. New machines, new explosives, and new mining methods are reducing the cost of extracting minerals from the ground; and over-all costs are lowered by wider adoption of bulk mining instead of highly selective mining, now that means have been found to remove admixed impurities mechanically.

The "electric eye" and thermostatic devices now control processes that involve high temperatures. An "electric ear" regulates the load of grinding mills to the optimum point, reducing its feed when the sound is muffled and increasing it when the mill gets too noisy. Chemical control and physical tests have been extended. Better standardization and clearer understanding of consumers' requirements have reduced the variety of products and eliminated unnecessary lines. As certain specifications have grown more rigid they have actually been simplified and made less liable to misinterpretation.

Many industrial minerals are used in pulverized condition. The biggest dry-grinding job in industry is the grinding of cement clinker, and a number of portland cement companies are now obtaining 20- to 50-percent increases in grinding efficiency by the employment of "grinding aids." It has long been known that additions of certain substances, such as coal or rosin, prevent packing of fine material and remove the coatings from balls and liners of grinding mills, probably by charging particles of the material with static electricity. During the last few years it has been found that an even better gain in grinding efficiency (though actually less dispersion) can be obtained by adding minute amounts of complex organic compounds. After trying a great many products, the Dewey & Almy Chemical Co., Cambridge, Mass., perfected a mixture of triethanolamine salts and certain calcium salts of modified lignin sulfonic acid which was named TDA. In addition to speeding up grinding, it materially improves the quality of cement because it also disperses the cement particles in mixing concrete and catalyzes the hardening reaction. This

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triple-effect material is sold as dry-powder, but is fed into the mill as a water solution very much as flotation reagents are fed into concentrating-mill circuits. For full effect on strength and workability 1 part is used to 1,520 parts of cement, but for grinding aid only, a 1:3000 ratio suffices. TDA is the only material other than gypsum whose addition to ground cement has been approved by the American Society for Testing Materials (A.S.T.M. Committee C-1). The cost is about 1 1/2 cents per barrel for ordinary cement and 3 cents for high-early-strength cement.

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AGGREGATES[4/]

An increase of 10 to 20 percent over 1938 production figures is anticipated for sand and gravel and also for crushed stone. In July 1939

4/ For further technologic data on this and other subjects discussed in this paper, see Bowles, Oliver, Recent Progress in Nonmetallics: Min. and Met., vol. 21, No. 398, February 1940, pp. 95-100.

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groups producing the three types of aggregates - crushed stone, gravel, and slag - agreed upon further simplification of specifications (Simplified Practice Recommendation R163-36), which establishes closer tolerances and eliminates 12 sizes.

Sand specifications are growing so rigid that production methods and equipment for making finer sizes may have to be changed. Following experience at large dam projects in the Far West, an eastern company has introduced a series of Dorr classifiers to fractionate sands into several sizes, which are combined later to give a sand having a definitely controlled modulus of fineness.

In Pennsylvania the State Department of Highways recommends square-mesh testing sieves for crushed stone, a real help to producers who use square-mesh screens in production. Still another trend in specifications is to combine two diverse sizes of concrete aggregate to obtain a denser mixture. Common requirements are 1/4 inch to 1 inch, and 1 inch to 2 1/2 inches. In the past 2 or 3 years gravity separation is being employed to some extent in the sand and gravel industry to remove shale, shell, coal, lignite, and soft or porous particles generally. Many of these particles, being more easily crushed, tend to be more plentiful in the smaller sand sizes. Log washers are employed more and more to eliminate clay and friable pieces from crushed stone.

The wide use of graded aggregates impregnated with bituminous material on secondary roads has led to accumulations of fines (minus 3/8 inch) at crushed-stone plants. Several hundred thousand tons of such material were used in concrete construction in Pennsylvania in 1939. In that State there has been a growing use of low-priced materials for secondary roads, including field stone, discarded ganister, mine waste, "red dog" (burned shale), and slag.

That improvement of products does not necessarily impair efficiency is indicated by a comprehensive study sponsored by the Bureau of Mines in cooperation with the W.P.A. For the crushed-stone industry, according to the report recently published, the annual production per man employed jumped from 1,200 tons in 1913 to 2,800 tons in 1936.

Lightweight aggregates are growing more important, being used in bridge decks and in general construction. A recent development is to employ them in precast units and special shapes, including masonry and back-up units, building brick, floor beams, columns, roof and floor tile, and slabs.

ASBESTOS

Domestic output of asbestos is still growing, but only a small fraction of the domestic supply is produced in the United States, and increasing tonnages of the better grades used in fabrics and in making magnesia-asbestos insulation and asbestos-cement products have been coming

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from far-off Rhodesia and South Africa. Even though war conditions seriously restrict overseas shipments, the United States should be able to meet all of its needs from Canadian mines, which lie only about 80 miles north of the Vermont border. Canadian mines and mills operated virtually at capacity throughout 1939. Late in the year shipments to the United States increased, and tonnages that formerly would have been destined to Central Europe were diverted to new markets, particularly South America, Australia, and the Far East. Prices were unchanged in 1939, and American contract quotations were reaffirmed for the first quarter of 1940, notwithstanding a 10-percent mark-up in Canadian currency quotations.

A deposit of blue asbestos, formerly produced commercially only in British Africa, has been reported in West Australia. A small trial shipment already has been received in the United States.

No real substitute has yet been found for asbestos. In the heat-insulation field glass wool and other products afford competition, but asbestos still is deemed indispensable for automobile brakebands and clutch facings. Nevertheless, the General Motors Corporation was granted a patent in 1939 for a brake lining of glass fiber bonded with synthetic resin.

BARITE

Germany long has been the leading world producer of barite, normally contributing about one-half of the world total output and formerly supplying most American plants along the Atlantic seaboard. Imports of crude barite into the United States from Germany have dwindled since 1929, and exports of ground barite to oil-well drillers in Latin America and Trinida probably exceed imports at present. Germany has now been cut off by the war, and virtually the only imports during the latter part of 1939 came by sea train from newly opened mines in Cuba. Curtailed imports have benefited chiefly producers in Georgia because the Missouri industry has depended largely on inland markets. A slightly increased output in the central part of Missouri was counterbalanced by a decrease in the southeastern area. New developments and increased production have been noted in Nevada and near Magnet, Ark.

In Canada, where virtually no barite has been produced for many years one of the old mines in Ontario is being reopened, and attention has been drawn to the Lake Ainslie occurrences on Cape Breton Island.

BAUXITE

At least 10 oil refineries are now reported to be using bauxite. Whereas natural bleaching clay (fuller's earth) ordinarily loses its efficiency after 20 cycles, properly treated bauxite may be revivified indefinitely. It works well, however, only with oils of the paraffinic typ

For calcining bauxite to be used for refractories and abrasives a Dwight-Lloyd sintering machine has been installed at one plant in lieu of the usual rotary kiln.

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BENTONITE

Production of bentonite increased in 1939. Three plants were built in Mississippi and Alabama, and although no new plants were built in the Black Hills region the capacity of the two producers in South Dakota and the three in Wyoming was enlarged. The principal outlet for Wyoming-type bentonite is still in the manufacture of synthetic molding sand and the rebonding of old sand. A new development, however, is the use of southern (nonswelling) bentonites for rebonding molding sands, for which purpose, it is claimed, they are better even than the Wyoming type. Other leading uses of bentonite are for oil-well drilling mud; for bleaching petroleum products; in the manufacture of cement and ceramic products, soaps, refractory materials, paper, cosmetics, water softeners, sealing agents, paints, medicinal emulsions, and roofing; for deinking newsprint and clarifying dry-cleaner fluids; as the core of earth-fill dams; and as lining for irrigation ditches. This list is far from complete, and new uses for bentonite are being found every year.

One of these new uses is as a coagulant in the white water at paper mills. In addition to clarifying the water so that it can be used over again, some of the bentonite adheres to the fiber and improves the paper. Grit-free bentonite, all under 5 microns and 90 percent minus 0.2 micron, may be included in the new National Formulary, owing to its important uses in pharmaceuticals. Serious leakage was averted in a 10,000,000-gallon municipal water reservoir at Corpus Christi, Tex., by using bentonite to seal the expansion joints. One of the most interesting developments in the use of bentonite is "Alsifilm", best known as a potential substitute for mica. (See Mica.)

A 40-inch layer of high-grade bentonite has lately been traced for a considerable distance in Clarke County, Ala., the first occurrence of commercial size and quality so far found in that State. It is being used by Quality Earths, Inc., as bonding clay. Further increase in activity can be recorded in Mississippi. Nonswelling bentonites in this area are principally acid-treated for oil bleaching but are also being used for foundry work.

The most widely used bentonite is 200-mesh powder, currently worth $10.25 per ton f.o.b. Black Hills shipping point, in 100-pound bags, carload lots. However, Wyoming-type bentonite is also prepared in pellet form, 30- to 40-mesh; and a dried and finely crushed product, mostly 4- to 20-mesh, is sold in carload lots at $7 a ton in bulk and $8.75 in bags. In common with shippers in other industries, bentonite producers had some difficulty in getting bags, as both burlap and kraft paper have increased 50 percent or more in cost.

BORAX

A three-fold increase in consumption of borax in 2 decades has been due primarily to its use in making glass and enamels. Exports in 1939

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were curtailed by closing of the German market, but production was larger than in 1938 owing to increased demand in the latter half of the year. Interesting is the growing use in mixed fertilizers; this means little in the way of tonnage but is important in the stimulation of plant growth and prevention of certain plant diseases, it is claimed.

Prices remained unchanged in the United States and have been reaffirmed for the first quarter of 1940. In Europe there was an advance of £4 per ton.

CARBON DIOXIDE

Carbon dioxide is now being obtained directly from limestone by Frozen Carbonic Corporation, Neville Island, Pittsburgh, Pa., using an improved Gillette process. Calcination is accomplished in such a way that the carbon dioxide obtained from the stone is uncontaminated by fuel gases. It is claimed that the product of this plant is 98 percent pure and is odorless and colorless. Lime is a byproduct.

CEMENT

Domestic production and shipments of portland cement were higher in 1939 than since 1931, but the shipments - 122,276,000 barrels (376 pounds each) - were still off 30 percent from the 1928 peak of 175,838,332 barrels valued at $275,972,945. Productive capacity in the United States (149 active, 13 idle plants), currently estimated at 258,000,000 barrels annually, has not changed much for several years but will be augmented in 1940 by recent completion of two large, new plants, one in California and one in Puerto Rico. Stocks of cement and clinker at mills were normal in 1939, although diminishing steadily. Imports increased slightly. Sentiment in the industry is more buoyant than at any time since 1930, particularly in respect to further revival in sales for small repairs and improvements, which represent an amazing proportion of total cement sales in normal good times.

The Margaret Hayden Rorke award for the best achievement among American Trade Association executives went in 1939 to the Portland Cement Association for its design of a "farm-to-market" light-traffic soil-cement road surface costing only $5,000 a mile. A new type of high-plastic mason cement is now on the market; dried clay replaces lime in this mixture. In Belgium, Government tests show that a supersulfate cement (Sealithor) - made from granulated blast-furnace slag, a little slaked lime, and an extraordinary amount of calcium sulfate (7 percent SO_3) - is unusually impervious, hardens in sea water, expands slightly on setting, is resistant to chemical attack, and is a little stronger than portland cement. Claims have recently been made that iron oxide additions promote easier calcination of portland cement, increase its resistance to contraction and expansion and to sea and sulfate waters, and increase strength.

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The new 7,000-barrel-per-day plant of the Permanente Corporation near Los Altos, Santa Clara County, Calif., will use raw material from a limestone deposit that has been rejected by previous investigators because of its high chert content. This impurity will be eliminated by the flotation process pioneered by the Valley Forge Cement Co. The latter company, which has employed froth flotation at its West Conshohocken (Pa.) plant since 1934, developed during 1939 a modification whereby excess mica also is removed. This is accomplished by cationic reagents and reduces alumina, alkalies, and magnesia enough to permit making all standard types of portland cement from available raw materials.

Froth-flotation equipment has been added to the plant of the National Portland Cement Co., Brodhead, Pa. At Leeds, Ala., the Universal Atlas Cement Co. has rebuilt its plant entirely, converting it into one of the most modern wet-process plants in the country. Its Woodford remote-control rock haulage system, Dorr thickeners for dewatering slurry, and air-quenching of clinker to facilitate grinding are notable features. Sudden cooling of white-hot clinker as it comes from the kilns tends to create minute fractures, and the introduction of clinker coolers of the air-quenching type is receiving wide attention throughout the industry.

New and highly efficient dust-collecting systems have been installed by the Louisville Cement Co., Speeds, Ind., and the Kosmos Portland Cement Co., Kosmosdale, Ky. The Medusa Portland Cement Co., Wampum, Pa., also has installed new dust collectors and markets the recovered dust for liming land.

The companies mentioned, as well as other cement manufacturers, have introduced various mechanical improvements, and mention may be made of the tendency to use trucks instead of track haulage in cement-rock quarries (especially in the Lehigh Valley district of Pennsylvania), and also to maintain crushing equipment on the quarry floor (belt conveyors being used to transport the rock from crusher to mill). Unburned magnesite brick are being used more and more in cement-kiln linings, and in some installations an insulating layer has been placed between the magnesite lining and the shell. Such insulation has been used before in the cooler part of kilns but not in the burning zone.

Mineralizers to facilitate clinkering and to accelerate the rate of silicate formation (thus conserving fuel) have been studied by the National Bureau of Standards: fluorspar and magnesium fluosilicate were found to be effective and advantageous. Crystallizing the trend toward special cements, Committee C-1 of the A.S.T.M. has for its consideration of specifications, grouped cements under five general types, as follows: (1) Ordinary portland cement requiring no special qualities; (2) cement for use in concrete subject to moderate sulfate action and moderate freezing and thawing; (3) high-early-strength cement; (4) low-heat cement; and (5) sulfate-resistant cement. The new or improved specifications if adopted will tend to increase production costs, for they will demand careful preparation of raw materials (even beneficiation may be necessary), as well as fine clinker grinding and rigid supervision of insoluble material, free lime, and alkali.

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CLAY (BLEACHING)

According to Schroter,5/ bleaching clays may be divided into (1) naturally adsorptive, (2) activable, and (3) natural semiadsorptive clays. The first class comprises natural bleaching clays, which hitherto have been classed as "fuller's earth," a term rapidly losing favor because it is not precise. The second group consists mainly of bentonites whose latent adsorptive capacity is increased or improved by drastic chemical treatment (usually leaching with mineral acids). The third class comprises common bauxite. Natural and activable bleaching clays consist mainly of montmorillonite. This mineral may be replaced by saponite or beidellite, but the kaolinite group of minerals is usually absent.

Owing to the wider use of colored fuel the use of bleaching clays to produce water-white gasoline has declined, but the big outlet is still in the petroleum-refining industry for percolation or contact processes. Naturally adsorptive clays have been used widely in percolation treatment, and percolation pellets have been made recently from fine fuller's earth by a simple extrusion method that forces the moist clay through perforated dies in spaghettilike strands, which are cut into short lengths and dried. The other principal method of treating petroleum is contact filtration, wherein finely ground clay is agitated with the oil and later removed in a filter press. This method is used not only for lubricating oils but for all manner of edible and nonedible oils, fats, hydrogenated shortening compounds, some oleomargarine, and even inorganic substances. Both methods are being used outside of the oil or fats industry - especially for decolorizing and recovering chemical-plant solvents and dry cleaners' liquids

Finely ground activated adsorbent clay recently has been used in a patented method of combined fractional distillation and contact filtration, the oil-and-clay slurry being subjected to normal fractionation and the various fractions that pass off through the tower being decolorized and purified on the way. Perhaps the latest and most spectacular application of adsorbent clays is in the catalytic refining of petroleum oils, whereby the heavier hydrocarbons are broken up so as to increase the gasoline yield With the addition of activated adsorptive clays cracking takes place at slightly lower temperatures and at much lower pressure, and about 50 percen of the heavy residues that would remain in thermal cracking may be converted into gasoline of a natural octane rating equivalent to that of the best premium motor fuels.

Although most activable clays are bentonites, some definitely are not because they have not been formed by devitrification of ash or tuff. Most activable clays are of the nonswelling type and do not form stable clay-water gels; however, they are soapy and seldom contain under 25 percent

5/ Schroter, G. A., Bleaching Clays Find Increasing Use: Eng. and Min. Jour., vol. 140, No. 11, November 1939, pp. 35-38, 40.

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free moisture. The structure of the best types reminds one of yeast cake, and the color is commonly white, yellow, or some light pastel tint.5/

CLAY (CHINA)

Domestic production of high-grade clays in 1939 probably was almost as great as the all-time record output in 1937.

American clays have displaced imported clays for many uses, and recently cheaper coating clays, produced by centrifuging high-grade domestic clays, have competed with the best clays imported from overseas and even with satin white. The last stronghold of English clays has been in making hotel china, certain kinds of sanitary ware, and electrical porcelain. All-American bodies have been developed, even for these wares, but the higher softening point and usually inferior color of domestic clays have delayed their adoption in the manufacture of these relatively high grade products; however, domestic clays have been used to a rapidly increasing extent in the production of sanitary ware, and their increasing use in this field has been accelerated by war conditions, which have virtually cut off supplies from Continental Europe and impeded shipments even from Cornwall. At present the main obstacle to employment of South Carolina or Georgia clays in tableware and other vitreous china is the color after firing. These clays contain not only iron and a little titanium, but, as recently discovered, up to 0.08 percent vanadium oxide.

Prices of high-grade clays remained virtually unchanged during 1939, paper-filler clays being sold mostly at $7.50 to $8.50, and the better class of coating clays at $20 to $30 a ton f.o.b. mines. Rubber clays, which are in about the same price class as paper filler, were advanced slightly, and all grades of clay were advanced 50 cents a ton after January 1, 1940.

The Southern Experiment Station of the Bureau of Mines has conducted successful experimental work on the recovery of kaolin by froth flotation from clay washery waste. Progress is also reported on fractionating ball clays by sedimentation. The Electrotechnical Laboratory of the Bureau of Mines at Norris, Tenn., during 1939 conducted extensive tests on substitution of domestic ball clays and kaolins for English clay in heavy sanitary ware. Promising results have been obtained, but the work is still incomplete.

DIAMONDS

World production of diamonds in 1939, as in 1938, was approximately 11 million carats, but notwithstanding the fact that prices were a little firmer, the value was less, probably around 40 million dollars; owing to the larger proportion of industrial stones.

5/ Schroter, G. A., and Campbell, Ian, Geological Features of Some Deposits of Bleaching Clays: Am. Inst. Min. and Met. Eng. Tech. Pub. 1139, Metals Technol., January 1940, 31 pp.

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The substitution of borts for carbonados and the use of smaller and smaller diamonds for industrial purposes continue. One innovation is the employment of beryllium copper under the trade name Vankolite for use in cast-setting diamond core bits and reaming shells. Drill bits using this tougher and harder metal have increased tensile strength and improved holding qualities owing to the close bond between the metal and the diamonds. Before the advent of mechanical setting methods diamonds had to be placed in the crown laboriously by hand. The newer technique permits proper spacing of several hundred small stones over a comparatively small circular area at negligible cost.

Small borts, it is claimed, would be preferable to large stone, even if they were more expensive, and of course they cost less. Small crystals are said to be sounder and harder than large ones. A typical drilling bit contains 178 stones having an aggregate weight of 7 carats or, roughly, 25 stones to a carat. Abrasive wheels are now made by adding even smaller diamonds to powdered metal or bonded compositions and sintering to a solid mass. Because of the wider use of the extremely hard alloys that are difficult to shape, diamond-bearing tools and grinding wheels are much more in demand.

In the South African fields high-intensity magnetic separators were introduced early in 1939 to remove garnet and other feebly magnetic minerals from the gravity concentrates, thereby facilitating subsequent treatment on grease tables.

DOLOMITE

The manufacture of dolomite brick has become practical only in the past 2 or 3 years, since methods have been found for preventing hydration of the lime content when not in use. Dolomite brick at present are used primarily in open-hearth furnace bottoms and in arc furnaces, where it is claimed they give as good life as magnesite brick at only two-thirds the price. Better spalling resistance must be developed, however, before they can be used in exposed positions in periodic furnaces where temperature changes are a factor. The main objection to dolomite refractories, of course, has been the high lime content which, unless inhibited, may cause disintegration either by hydration or by dusting. Tar coatings were the first means employed to prevent hydration of dead-burned dolomite in storage, but this protection disappeared once the material was exposed to high heat. Another method is to coat the grains with slag, which is satisfactory as long as the glassy films do not crack. A third method is to convert the lime itself to a nonslagging form, such as the silicate.

Dusting occurs when beta-dicalcium silicate changes to gamma-dicalcium silicate, causing a 10-percent increase in volume. This may be overcome by adding small amounts of boric or chromic oxide to the batch. In general, therefore, stabilization of dolomite may be achieved by adding some siliceous material, such as magnesium silicate, to inhibit hydration and a stabilizer to diminish dusting.1/

1/ Chesters, J. H., Recent Developments in Basic Refractories Increase Furnace Applications: Brick and Clay Record, November 1939, pp. 57-58.

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In North American the problem of rendering harmless the lime content of basic refractories was the subject of cooperative research by Canadian Government agencies and the producers of so-called magnesitic dolomite in Quebec. A similar material is reported as now being made in the United States from dolomite, with additions of Nevada brucite. The freight is an item, but it is probably less on brucite than on crude magnesite owing to the higher MgO content. The Washington magnesite producers have also experimented with the high-lime product, which is readily obtainable on the margin of magnesite deposits. These materials intermediate in composition between dolomite and magnesite are quick-setting and may be used for furnace bottoms in much the same way as is grain magnesite mixed with slag.

FELDSPAR

Notwithstanding the increasing use of competitive materials the domestic demand for feldspar was active in 1939. Shipments greatly exceeded those of the preceding year, though they probably were short of the all-time record of 1937. The trend toward more feldspar in container glass continued, and the reduction of imports of pottery from Japan and Czechoslovakia boosted the business of American potters. Prices of feldspar held firm, with a rising tendency, until the last 2 months, when sharp competition caused reductions of 20 to 30 percent. The industry still has about four times as much grinding capacity as it needs.

Aplite, which came on the market late in 1938, is a white, massive rock consisting of albite, sericite, zoisite, microcline, and other materials and occurs extensively near Piney River, Va. After grinding and screening through 20-mesh and elimination of fines the product averages 0.27 percent ferric oxide. Although it can be used only in amber, green, or other colored-glass products, a good market has been found for it among manufacturers of certain types of glass containers. The fines (minus 100-mesh) contain even more iron than the sand sizes, and a market for this material would be a boon to the company.

Some of the New England feldspar deposits are being reworked for graphic granite and similar natural mixtures of feldspars and quartz. The flotation mill of the Golding-Keene Co., at Keene, N. H., was inactive in 1939, but the Bureau of Mines has continued its research in the separation of quartz and feldspar; excellent results are obtained by additions of lauryl amine hydrochloride and fluorine-bearing acids or salts in an acid circuit.

GRAPHITE

In 1937 and probably again in 1939 domestic consumption of graphite was back at 30,000 tons, almost three times what it was in the early 1930's and roughly the same as before the World War. At present, however, only one-tenth of this total is high-grade crystalline graphite as against two-thirds a few decades ago. During the World War the shortage of graphite

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was a matter of great concern principally because of its use in crucibles, which then were needed for the manufacture of high-grade steel as well as numerous special alloys and castings. Present-day needs for making crucibles are only 2,000 tons a year contrasted with 15,000 tons in 1913 and 17,000 in 1919. Formerly Ceylon plumbago lump or chip was virtually the only material acceptable to American crucible manufacturers, but now they use Madagascar flake graphite almost exclusively.

The United States has never been a large producer of graphite, though it ranks next to Germany as the leading consumer of high-grade material. Domestic reserves are large but yield meager percentages of flake, and the flake is too small or too fragile to suit the crucible makers. Apart from small amounts of amorphous graphite mined in the West and used principally from making paint, the only domestic production of graphite in the United States in 1939 was in St. Lawrence County, N. Y. where the Long Valley Ore Co. has opened up a deposit that yields a high-grade concentrate carrying 80 percent or more carbon and acceptable to manufacturers of foundry facings and batteries. A fair portion of the material is flake, but the flakes are small and apparently unsuitable for crucible making. Domestic production figures cannot be published.

Early in 1939 stocks of the more important kinds of graphite in the United States were considered ample for a year or more, but after the outbreak of the war in Europe there was a substantial increase in consumption, and supplies of Madagascar graphite in particular were quickly depleted. Material on order in Madagascar came under the embargo on exports when Franc declared war on Germany, and although permits have been issued for several shipments the domestic supply of this type of graphite was not satisfactory at the end of the year.

The leading importers and dealers of graphite did not raise their prices even during the final quarter, when it was necessary to ration supplies to some extent. Speculative purchases were discouraged, but an industry-wide increase in actual consumption reduced stocks and the questio arose as to whether these stocks will be replenished at current quotations, in view of the increases in prices abroad which in many instances are not quite canceled by the depreciation in French and British currencies. Mater advances in freight rates from Ceylon also were reported, a late quotation being 63s. per long ton compared with 52s. 6d. during the spring and summer

GRINDING PEBBLES

Although steel balls have largely replaced flint pebbles in grinding ores and other materials in concentrating plants, they are not so suitable for pulverizing feldspar and other ceramic raw materials which must not be contaminated with iron. Flint grinding pebbles have been imported principally from Denmark, although at one time a fair supply was obtained from crude chalk formerly imported in considerable amounts for grinding into whiting in this country. Shipping difficulties occasioned by the present war may curtail imports, and so far the only domestic substitute in volume

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has been quartzite quarried near Jasper, Minn., which for several years has been dressed for use as liners or pebbles. Small quantities of true flints have been produced in a small way at Encinitas Beach, near San Diego, Calif. A California gold-mining company has used quartzose ore for grinding in its own plant, but it is doubtful if such material would afford a suitable substitute for commercial pebbles.

GYPSUM

In 1939 the gypsum industry had its best year since the late 20's. The spectacular uptrend in sales of gypsum lath continued, gaining 40 percent over 1938, and moderate gains were made in sales of other products. Two new gypsum mills have recently been completed in the South.

The only technical development of importance was the introduction of a highly efficient automatic machine for perforating gypsum lath. Among new uses is a fire-protective covering for steel beams, consisting of 3 parts by weight of neat gypsum plaster to 1 part of expanded vermiculite. A new high-strength specialty plaster has also been reported.

ICELAND SPAR

Although calcite in the form of limestone and marble occurs very commonly in nearly every State, perfectly crystallized water-clear calcite in pieces large enough and excellent enough to be suitable for use in optical instruments is rare. This variety, known as Iceland spar, is obtained chiefly in South Africa and Iceland. Very little has been produced in the United States, but during 1939 a promising deposit was found about 30 miles south and east of Taos, N. Mex. The deposit is circular in outline and occurs along a fault plane in pre-Cambrian rocks. Tests now in progress in optical laboratories indicate that the material is of superior quality.

KYANITE, ANDALUSITE, AND DUMORTIERITE

Domestic production of kyanite probably increased in 1939 as a result of Phosphate Recovery Corporation operations near Pamplin, Va. Other eastern producers are the Celo Mines, Inc., Burnsville, N. C., and E. C. Noble and the Southern Mining & Milling Co., both operating near Clarkesville, Ga. A promising deposit of kyanite in Alabama has aroused some interest but awaits increased demand before being developed commercially. Imports of Indian kyanite were well-maintained, notwithstanding shipping difficulties during the last 3 or 4 months. As the demand for high-grade refractories has been stimulated by recent industrial recovery, domestic production and imports of kyanite and allied minerals seem to be on the uptrend.

Celo Mines, Inc., is producing a low-iron kyanite that is finding a market as a glass batch ingredient, but the principal outlet for both domestic and imported kyanite seems to be in the manufacture of brick and

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other refractories for glass works and other industries in which a super-quality acid brick is needed. Prices of the raw kyanite range from $15 to $25 per ton according to quality, and kyanite brick cost up to $500 a thousand. Andalusite and dumortierite, used chiefly for spark-plug cores, rarely appear in the open market but have been sold at around $100 a ton.

The Southern Experiment Station of the Bureau of Mines has demonstrated that froth flotation will yield a concentrate as high as 99 percent kyanite and as low as 0.3 percent Fe_2O_3, with recoveries up to 96 percent. Celo Mines, Inc., after careful experimentation, is planning a commercial flotation plant. The Bureau of Mines is conducting tests to determine the feasibility of using finely ground kyanite flotation concentrates obtained from Georgia ores to make dry-pressed refractory brick without precalcination.

The dumortierite property of the Champion Sillimanite Co. at Oreana, Nev., was active during 1939, and its White Mountain andalusite mine near Bishop, Calif., produced about 2,000 tons during the year.

LIME

Domestic production of lime in 1939 was much greater than in the preceding year and probably exceeded slightly the 1937 output of 4,124,165 tons worth $30,091,168, which compares with 1,959,990 tons at $12,302,231 in 1932 and a peak of 4,580,823 tons valued at $42,609,141 in 1925. Sales of lime for building uses have lagged behind recovery in building construction, still the largest use, but gains in consumption for refractory purposes, metallurgy, paper mills, and glass works have helped to offset the losses caused by general slowing down in building activity and competition from other construction materials.

As shown by a recent Bureau of Mines study, very small plants no longer furnish more than an insignificant percentage of the total lime used in the United States. Medium-size companies producing 10,000 to 50,000 tons annually are most regular in their operations. Big companies, producing 50,000 tons or more a year, show wide fluctuations in operating rates. Although kiln capacity has increased steadily, the number of activ kilns has decreased. That the industry is overbuilt is evident from the fact that from 1917 to 1938 the output was scarcely more than one-half as much as even the active companies would have supplied if operated at full capacity.

Azbe 8/ claims that, in general, lime is calcined at too high a temperature and that its quality is impaired thereby. Consequently lime of better quality could be made by controlling the temperature more accurate throughout the burning zone.

8/ Azbe, Victor J., Calcining, Hydrating Lime, Part 3: Rock Products, vol. 42, No. 8, August, 1939, pp. 72-74.

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One of the new uses for lime is application to treatment of cannery wastes, reducing stream pollution. Additions of 4 to 10 pounds of lime, supplemented by ferrous sulfate, for each 1,000 gallons of waste were found effective. Less important from a tonnage standpoint is a proposed employment of half-filled cans of quicklime behind library shelves to reduce humidity and prevent mildew during the summer months. Interesting, too, is the contribution of lime to the manufacture of nylon fibers which promise to be used extensively in waterproof, fireproof, and acidproof as well as general service fabrics. Lime manufacturers, however, are becoming more and more interested in making masonry mortars and other advanced products in which lime is one of the major constituents.

LITHIUM MINERALS

A detailed plane table survey has been made by the Federal Geological Survey of the spodumene deposits in the Kings Mountain district of North and South Carolina, and a pilot plant for beneficiation by flotation of spodumene-bearing rock from this district has been erected at Spruce Pine, N. C. Tests indicate that a spodumene-microcline product can be obtained that, when used in place of feldspar in whiteware bodies, will lower the fusion temperature several cones, thus conserving time and fuel.

The Black Hills Tin Co., Tinton, S. Dak., has perfected a flotation process for separating spodumene from quartz. The company property is said to contain a 90,000-ton deposit of spodumene quartz so finely crystallized that it was formerly thought to be feldspar. The concentrate contains 6 percent or better lithium oxide. After operating experimentally for 6 weeks during the summer of 1939 the company proposed to introduce into its present tin-tantalum concentrating mill a spodumene circuit capable of producing several carloads a week.

MAGNESITE

Stoppage of supplies of Austrian magnesite, owing to the war, combined with sharp increase in demand, has necessitated certain readjustments in the magnesite industry. After subnormal activity in the early months of 1939, domestic production has been speeded up. Increasing supplies may be obtained from Manchukuo and perhaps China. Russian magnesite is still on the market, but American consumers have found it variable in quality. British refractory manufacturers have been increasing their consumption of Greek magnesite, the former prejudice against the use of microcrystalline ore, so-called amorphous material, having largely disappeared owing to research since 1914. Normally England's annual needs are supplied approximately as follows: Austria, 10,000 tons; Greece, 8,000; India, 4,000; Canada, 1,500; and U.S.S.R., 1,000.

Freight rates, even from the Orient, advanced greatly after the outbreak of the war in Europe. From Dairen to United States Atlantic ports cargo rates jumped from $10 to $13 a ton, with a $20 figure mentioned as an early possibility. Imports from Manchukuo are credited in the United

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States import statistics as coming from Kwantung and began to increase markedly 2 years ago. This material also is not always quite uniform, but it is usually low in iron - under 2 percent - and had begun to displace Austrian material even before war was declared. The inclusion of Austria and Czechoslovakia in Greater Germany gave the German Government almost complete control of the Magnesite Cartel, which had an influence over production in Hungary and in other parts of the former Austro-Hungarian Empire. Shipments from Yugoslavia are still possible but are subject, of course, to the handicaps of moving through the Mediterranean and war-infested parts of the Atlantic Ocean. A little Chinese magnesite has been imported into the United States, apparently from areas not controlled by the Japanese. Large deposits of high-grade magnesite have been reported in Chosen, but so far as known, no magnesite from this source has been exported to the United States.

In making magnesite brick American plants have depended mainly on imported grain magnesite. This has been due less to technologic than to economic reasons. The plants are situated at the Atlantic seaboard where, of course, overseas shipments do not have to bear the additional expense of railroad transportation. Again, the draw-back on duties paid on imported magnesite can be refunded in respect to export products in which they are actually used; since the doctrine of substitution (applied to manufactures of nonferrous metals) has not been accepted as applicable to domestic magnesite used in refractory products exported, this factor is not unimportant. Already as much as one-third of the magnesite used in refractory brick and other shapes may be domestic, the proportion being probably large in magnesite-chrome brick. Even straight magnesite brick can be made from domestic magnesite alone without any impairment of quality although the trend is to use mixed materials in the manufacture of high-hea duty brick. Virtually all chrome brick now contain a certain amount of magnesite; and according to at least one authority, the most satisfactory all-around mixture is 75 percent chrome ore and 25 percent dead-burned magnesite. Owing to the displacement of medium-duty by high-duty refractories the total consumption of straight-magnesite, straight-chrome, and magnesite-chrome brick has increased, but owing to the preferences for mixed materials, about twice as much chrome ore as dead-burned magnesite is estimated as now consumed in the manufacture of these high-grade products.

MAGNESIUM SULFATE AND OTHER MAGNESIUM COMPOUNDS

Kieserite, a hydrous magnesium sulfate ($MgSO_4.H_2O$), has been produced commercially almost exclusively at Stassfurt, Germany, where it occurs abundantly in the potash mines. Formerly it was calcined and used chiefly as raw material for making Epsom salts ($MgSO_4.7H_2O$). Imports of kieserite were reported in official statistics of the United States for many years and averaged 6,455 long tons annually in 1910-14, after which they dropped and eventually ceased. Kieserite for fertilizer use is exempt from duty under Paragraph 1706 of the Tariff Act of 1930; but imports probably were small or nonexistent until 1935, when they were included in the official statistics with imports of "other substances used chiefly for fertilizer"

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amounting to 11,428 long tons valued at $142,902. In 1937 the imports under the latter clasification totaled 10,781 long tons valued at $99,054, and a study by the Chemical Division of the Bureau of Foreign and Domestic Commerce revealed that this was entirely kieserite. In 1928 kieserite again was listed separately in the official statistics, and imports aggregated 14,221 long tons. About one-third of this was imported into New England for use principally on potato fields in Maine, considerably more than one-third was entered at Florida ports for use on citrus fruits, and the remainder was used mainly by tobacco growers in Virginia and the Carolinas. In 1939 shipments diminished, with those of other German commodities, only 2,245 long tons valued at $14,511 being imported during the first 9 months before war conditions cut off further deliveries.

Beginning with 1935 the official statistics showed imports of "calcined magnesium sulfate or calcium kieserite (not fertilizer)" of 1,834 short tons valued at $30,291. This material is dutiable at 25 percent ad valorem under Paragraph 5 of the Tariff Act of 1930 as a chemical compound not specially provided for, and according to a study by the United States Tariff Commission it is used principally by rayon producers in coagulating cellulose solutions into filaments. After rising to 4,117 short tons valued at $71,889 in 1937, imports under this classification declined in 1938 and again in 1939.

Epsom salts, magnesium chloride, magnesium carbonate, and calcined magnesia are provided for at specific rates of duty under Paragraph 49 of the Tariff Act of 1930. Imports of magnesium chloride have not been large for several years and were reduced further in 1939. An increase occurred in imports of precipitated carbonate, which rose to a new record, probably as a result of the reduction in duty under the British Reciprocal Trade Agreement, which was extended to all countries except Germany. Domestic production of precipitated carbonate was 7,301 tons in 1937, as reported by seven producers to the Bureau of the Census, but most of this was technical or basic carbonate used for pipe coverings or other heat insulation, whereas imports are mainly for medicinal or pharmaceutical use.

A sharp increase in consumption of imported kieserite for fertilizer use during 1935-37 was due to increased recognition of the role of magnesium in plant growth. In 1939 the California Chemical Division of Westvaco Chlorine Products Co. successfully introduced water-soluble sea-water magnesium oxide to meet this need. This product carries three times as much magnesia as kieserite and is generally cheaper per unit magnesium content. It is sold to manufacturers of mixed fertilizers, especially those used in magnesium-deficient areas. In addition to its function as a magnesia carrier and soil conditioner and sweetener, it seems to improve the physical characteristics of the fertilizer itself owing to the absorption of free acid and excess moisture.

A process for making synthetic kieserite or magnesium sulfate from olivine was tested in 1939. Certain parts of a large deposit of olivine at Webster, N. C., are reported to contain 25 to 35 percent MgO and up to 1 1/2 percent nickel, which can also be recovered.

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Magnesol, a synthetic silicate of magnesium, has recently come into use as a competitor of bleaching clays in a newly patented process of oil refining.

MICA

Consumption of sheet mica and splittings during the last quarter of 1939 probably exceeded even the pace set during the first half of 1937, but owing to reduced activity during the earlier months the totals for the year fell short of a record although they probably exceeded the totals for 1938. Prices remained virtually unchanged until the outbreak of war in Europe touched off demand and threatened to create a shortage in Indian and Madagascan splittings. Stocks of splittings and of certain kinds of radio and electrical mica were abnormally heavy at the beginning of the year, and were well-maintained until consumption was stepped up in September and deliveries from Calcutta virtually ceased. In December one large consumer used up its stock of its most important grade of splittings, and none of the companies were able to maintain their raw-material inventories. At no time was there any dearth of supplies in Calcutta, but the heavy movement of burlap and other commodities resulted in a shortage of shipping space. This situation, however, began to improve toward the end of the year as more ships were routed from India to the United States. Shipments of amber splittings from Madagascar came under the French Government control and not until after the end of the year were licenses obtainable for even limited quantities for export to this country.

South American mica was freely offered throughout the year, and shipments came through with relatively little interference caused by war conditions. Domestic production was speeded in North Carolina, New England, and especially South Dakota, but production statistics are not yet available.

Prices of domestic mica advanced sharply, particularly on small sizes. Argentine and Brazilian sheet mica rose an average of perhaps 10 percent over the relatively high levels reached in 1938. For Indian splittings sterling prices and freight and war-risk insurance increased greatly, but in respect to bulk lines used in the manufacture of built-up mica products these increases were virtually offset by the decline in exchange. For more expensive classes of splittings, however, such as are used in insulating tapes, there were slight increases; No. 5 book packed splittings, for example, advanced from $1.25 to $1.40 a pound. The delivered cost of radio mica at American factories remained about the same as before the war despite the increases in sterling quotations. A threatened shortage of "cigarette" mica for airplane spark plugs was averted by employing selected domestic sheet.

Definite progress was made during the year in the development of Alsifilm as a substitute for mica splittings. This interesting product is made from bentonite, and after experiments with raw material from many domestic localities and from foreign sources, a variety produced by one

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of the Wyoming companies was selected as best suited for the process, chiefly because of its higher yield of ultrafine, colloidal material. Although it is possible to produce Alsifilm of high tensile strength and also material that is flexible or even creaseproof, it has not been possible to obtain a high degree of flexibility without sacrificing the properties that render the material a competitor of mica.

Aside from fundamental laboratory research, quasi-commercial developments are now being conducted under cooperative arrangements with various companies. One of these companies is investigating the production of a cambric-type insulating tape impregnated with Alsifilm; another is working on a combination of alsifilm with fiber glass, including both felted fibers and woven fabrics; and still other companies are directing their efforts to the production of substitutes for built-up mica sheet or board. Already commutator segments and other stampings have been made that appear to be acceptable substitutes for mica products. Large V-rings may also be produced, although the material does not seem at present to be universally suitable for molding plate. Experiments in the manufacture of heater plate are quite promising but are not far advanced as yet.

The technic of production of Alsifilm is quite simple. The raw bentonite is made into a 2 percent dispersion with water, which is allowed to settle or is centrifuged to remove the coarser particles. The colloidal material is then either evaporated or concentrated in a supercentrifuge to a 5- to 8-percent gel, which has the consistency of smooth paste and so can be spread over a flat surface and then struck off to an even thickness by passing it under a knife. The moist film is next placed under a bank of incandescent electric lamps with infrared reflectors, and films up to 4 or 5 mils thick are dried in this way in about 5 minutes, although thicker films cause difficulty. The final treatment is immersion in a hardening bath that renders the material water-resistant. Experiments have been made with both potassium hydroxide and lead acetate baths. The action is one of base exchange, and although the addition of potash yields a product that more nearly duplicates the chemical composition of the muscovite molecule, lead acetate is employed more commonly. The sheets are now made separately in 3-foot lengths and widths of 18 inches or more. Eventually, however, a continuous sheet may be produced and recovered in the form of a roll. In making commutator segments the next step is to paste these sheets together with shellac or other binder and to compress them in a heated press in exactly the same way as ordinary built-up mica sheets are made. Some difficulty has been experienced in cutting the built-up Alsifilm sheets into strips without breakage; but the stamping operations are conducted without difficulty, this operation being, if anything, easier with Alsifilm than with ordinary built-up mica. When shellac binder is used, the Alsifilm sheets are reported to have dielectric strength equivalent to 800 volts per mil, which is quite satisfactory. Although the individual films are rather brittle the laminated sheets are reasonably strong and will stand ordinary handling.

In addition to its use as a possible substitute for mica Alsifilm is being investigated as a substitute for paper, especially for permanent

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records. It takes ink well, can be strengthened by the addition of asbestos or other noninflammable fiber, and may be opacified with a dispersed pigment.

Mineral Wool

Statistics concerning mineral wool are not compiled by the Bureau of Mines but are obtained biennially by the Bureau of the Census. Preliminary reports indicate that production in 1939 exceeded that in 1938 but probably fell short of the 1937 peak. However, there was a boom in the sale of batts and strips, consumption of which has increased rapidly during the last year or two.

The Carney Rock Wool Co., an affiliate of the Carney Cement Co., Mankato, Minn., began construction of a new mineral-wool plant late in 193 The American Rock Wool Co. is spending $100,000 on improving its plant at Wabash, Ind. In August, 1939 it was reported that Superior Insulations, Inc., was about to erect a new rock-wool plant at Lagro, Ind. The Kentuck Stone Co. rock-wool plant at Mullins, Ky., was destroyed by fire in Februa 1939. It will probably be rebuilt.

No rock wool is manufactured at present in the Southeastern States, a slag-wool plants in this territory are found only in Tennessee and Alabama According to a recent circular (No. 10) of the State Division of Mines, Mining and Geology, Georgia is well-situated geographically, has ample woo rock resources and offers other advantages for establishing a plant. Consumption in this territory at present is only 1,000 to 1,500 tons of wool- most of which comes from Indiana, Ohio, and New Jersey—but might be incre

NEPHELINE SYENITE

Apart from possible commercial production in the Kola Peninsula, U.S.S.R., where it is a byproduct of apatite, world supplies of nepheline syenite come from Ontario. Preliminary reports indicate an output of nea 45,000 tons in 1939. The largest company, Canadian Nepheline, Ltd., at Blue Mountain, Peterborough County, ships most of its tonnage to the grin ing mill of its subsidiary, the American Nepheline Corporation, at Roches N. Y., where a fine-grinding unit has been added to supply fine-ground material for general ceramic uses. The main consumption, however, contin to be in glassmaking. The company mill at Lakefield, Ontario, supplies t Canadian trade; hitherto it has been running only half time but consumpti may increase with the building of new glass plants in Ontario. Two quarr operated also in Dungannon Township, Hastings County, Ontario, in a depos of coarse nepheline syenite pegmatite.

Prof. G. A. Bole, Engineering Experiment Station, Ohio State Univers is authority for the statement that the addition of nepheline syenite to pottery, semivitreous ware, sanitary porcelain, tile, and structural clay bodies has certain advantages. In general, it increases fluxing action a lowers fusibility, thereby speeding firing and saving fuel. It also increases translucence and reduces warpage and crazing, notwithstanding an increase in thermal expansion. Additions of 3 to 5 percent to structural clay bodies increase vitrification and mechanical strength, thus offsetti the greater refractoriness of many domestic ceramic clays.

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Russian apatite flotation-plant tailings are being considered as a source of aluminum, replacing bauxite. Soda, potash, and portland cement also may be manufactured as byproducts.

PHOSPHATE ROCK

Domestic production of phosphate rock during the first 6 months of 1939 was 3 percent larger than during the corresponding period of 1938. Shipments were 6 percent less, but for the calendar year a somewhat smaller decline is anticipated. Preliminary reports indicate that domestic consumption may have been larger than in 1938 but less than in 1937, whereas exports were seriously disrupted by war conditions.

Germany, which usually takes roughly half of the tonnage exported to Europe from the United States, was virtually cut off in the last quarter of the year. Neutral European countries are having difficulty in moving shipments from America, and our exports to Italy and Spain suffered from the barter arrangements whereunder French African phosphate is exchanged for pyrite, sulfur, and other commodities. Japan and Korea recently have taken about one-fourth of American phosphate exports, but Japan's shortage of shipping is beginning to divert attention to nearer supplies in Pacific Islands, a tendency that may be accentuated by nonrenewal of the trade treaty with the United States. Partly offsetting these prospective reductions, which began to appear late in 1939, increased demands for American phosphate rock are developing in Canada, South America, and South Africa.

The report of the Joint Congressional Committee to investigate the adequacy and use of the phosphate resources of the United States, which was appointed by the 75th Congress and which held hearings during 1938, was issued as Senate Document 21 (76th Congress, First Session) dated January 17, 1939. Its seven recommendations may be summarized as follows: (1) Appoint a committee to study potash, bauxite, and other minerals; (2) have an investigation made by the Geological Survey of reserves of phosphate and potash; (3) continue the T.V.A. work on fertilizers; (4) continue the A.A.A. plan of distributing concentrated fertilizers to farmers in lieu of benefit payments; (5) establish an experimental phosphate plant in the vicinity of the western deposits; (6) select noncommercial phosphate-bearing lands, if possible, whenever additional lands are required in Florida for use by the Forest Service, Biological Survey, or other Government agencies; and (7) enact legislation to protect American process patents. The Committee further sought and obtained from Congress an extension of time for additional report at the next session, beginning January 1940.

POTASH

The outbreak of war in Europe in September 1939 again cut off imports of German potash, but the situation now bears no resemblance to the disturbance created in 1914. Following the break-up of the international cartel, sales offices were opened for handling imports of French potash, and domestic production has expanded further, with the result that no increases in

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prices were made or are anticipated during the coming fertilizer season. It is stated authoritatively that American producers are able to furnish ample supplies for agriculture and industry. Although the present capacity of high-grade salts falls short of our total potash requirements by 150,000 to 200,000 tons of K_2O, this quantity can readily be produced in New Mexico, Utah and Maryland in the form of crude or manure-grade salts. Late in the year, by voluntary action of producers, exports of domestic potash were virtually suspended, thereby forestalling any threat of a shortage for domestic consumers.

Following an auction on October 18, 1939, the United States Department of the Interior awarded leases involving six potash units on Searles Lake, Calif.; four of them were acquired by the American Potash & Chemical Corporation and two by the West End Chemical Co., which has not hitherto been a producer of potash. The former company is now in a position to treat in its plant brine containing a higher concentration of potassium salts, and a 10-percent increase in potash production from Searles Lake is anticipated. The New Mexico deposits of the Union Potash & Chemical Co., affiliated with the International Agricultural Corporation, were developed further. The corporation announced its intention of marketing both sulfate and muriate during 1940. Should a shortage of sulfate develop in the interim, muriate can be substituted in many places. Supplies of sulfate probably are adequate for tobacco and a few other crops that need it most.

PYROPHYLLITE

There are now three producers of pyrophyllite in North Carolina. Formerly considered merely a substitute for magnesia talc in rubber making and similar uses, the mineral has now developed a variety of applications peculiar to itself. Recently its employment in ceramic bodies has increased rapidly. Another new use is as a refractory known as "pyroplastic", employed chiefly to patch disintegrated firebrick, thereby obviating costly shutdowns and lengthening the life of furnace linings. Recent tests indicate it is claimed, that the platy or schistose variety of pyrophyllite makes a satisfactory paint filler.

Production figures cannot be published separately, but reports from North Carolina indicate that during the final quarter of the year the output was exceeding previous records.

SALT

The Crystal White Salt Co. has begun production of salt from the brine of Great Salt Lake, Utah. The new solar evaporation plant on Stansbury Island near the south end of the lake is supplied with brine by means of a canal 3 1/2 miles long.

SLATE

Parsons Brothers Slate Co., Pen Argyl, Pa., has designed a new method of applying slate on roofs. It simplifies the process, reduces the weight,

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requires only half as much slate for a given area as when placed in the orthodox manner, and utilizes small sizes that accumulate around quarries and ordinarily are difficult to market. The small slates are placed edge to edge, with no side lap but with a 3-inch head lap. Between the slates and the sheathing are strips of heavy asphalt-impregnated felt with an asphalt coating. They also have a 3-inch head lap. Such low-cost roofs are said to be enduring.

Further tests by the Eastern Experiment Station of the Bureau of Mines indicate that waste slate is a raw material suitable for the production of lightweight aggregate. When calcined at a carefully controlled temperature the slate will expand to more than five times its original volume and still have a fairly high compressive strength.

SODIUM SULFATE

Mathieson Alkali Works, Inc., announces that a new plant is to be built on Lake Charles, La., to produce synthetic salt cake (sodium sulfate) by a new process. The product will be supplied to the paper industry.

STONE (CRUSHED)

The most striking gain in production of crushed or broken stone during 1939 for uses other than as aggregate (see Aggregates) was in fluxing limestone to meet the needs of an unusually active iron and steel industry.

Granite is being used increasingly as poultry grit. Georgia granite producers have stepped up production and are attaining nation-wide distribution.

Markets are expanding for byproducts of crushed-stone plants, such as stone sand, fillers, and abrasive dusts. One special product is a minus 3/8-inch plus 8-mesh limestone sand for use as antiskid material on icy pavements.

The Staso Milling Co. of Chicago, Ill., is constructing a new $260,000 plant in Marinette County, Wis., for crushing and processing roofing granules.

STONE (DIMENSION)

The gigantic figures of Washington, Jefferson, Lincoln, and Theodore Roosevelt, which are slowly taking shape high on the granite face of Mount Rushmore, S. D., under direction of the famous sculptor Gutzon Borglum, are nearing completion. This massive assembly shaped from time-defying granite probably will be classed by future ages as the most enduring memorial of the present era.

Prof. George W. Bain of Amherst College has developed a new technique for determining endurance of marbles, for directing favricators toward

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obtaining maximum translucence and weather-resistant or weather-aging effects and for studying the effects of fabricating methods on marble endurance and appearance. These studies are based upon knowledge of crysta lographic orientation of marble grains of the size of integranular spaces of the index of irregularity, and other physical and chemical phenomena. This new approach illustrates the service that a skilled geologist, chemi and physicist may render in the solution of problems relating to utilization and fabrication not only of marble, but of many industrial minerals.

The Shawnee Stone Co., producers of building limestone near Blooming ton, Ind., is employing wire saws successfully in its quarries. Several other companies in the district are giving consideration to the use of th equipment.

The Georgia Marble Co. has changed from open-pit to underground oper tion at one of its workings. The floor of the new drift will be inclined to parallel the color banding, thus improving the pattern of the finished product and conserving stone. Markets for building marble in the South have improved, but demands for monuments have declined.

Libby-Owens-Ford Glass Co. perfected in 1939 a new building unit to which the name Glastone has been applied. It is an opaque, colored-glass plate bonded to a lightweight concrete unit by means of a film of asphalt mastic.

A second edition of The Stone Industries, a 519-page comprehensive volume covering all phases of stone production and fabrication, was publi ed by the McGraw-Hill Book Co. in February 1939.

VERMICULITE

In 1939 the two producers of raw vermiculite at Libby, Mont., merged to form a new corporation, Universal Zonolite Insulation Co. (C. W. Kearn president), Chicago, Ill., which continues to mine the raw material and t ship cleaned and sized vermiculite to its own and other expanding plants various cities. Later the Masonite Co. undertook the merchandising in eastern territory of expanded vermiculite produced in this company's plan at Chicago, Ill., and Detroit, Mich., and also that manufactured by F. E. Schundler & Co. (Joliet, Ill., and Long Island City, N. Y.), International Vermiculite Co. (Springfield, Ill.), and Wyodak Chemical Co. (Cleveland, Ohio). The principal product is sold to building-material dealers in bag under the trade name Housfil, but smaller sizes are offered for use in lightweight concrete for roof decks and other construction. William H. I Hinchman, Barlum Tower, Detroit, Mich., has reported development of a ver lated block (6 by 12 by 24 inches) for outside walls and load-bearing par tions, made from graded vermiculite with portland cement as binder. Thes blocks will almost float on water and are claimed to have good insulating properties. They are laid staggered, but the ventilating ducts are desig to avoid accumulation of condensed moisture, even in freezing weather.

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Munne & Steele, Inc. (130 Lister Ave., Newark, N. J.) operated expanding plants in Newark, N. J., and Washington, D. C., using raw material from Montana and also from newly developed sources in North Carolina. The Mikolite Co. (1100 S. Mill St., Kansas City, Kans.), after being optioned to Lehigh Portland Cement Co., resumed operations under the original management, producing in addition to loose fill a varied line of insulating, acoustical, and lightweight plasters, cements, and coatings as well as stucco and textural finishes. Among its newer products is an extender for aluminum paints which, it is claimed, makes them work better than straight aluminum paint and increases coverage by 25 percent. Vermiculite for this purpose is only 2/100,000-inch in diameter, and 1 ounce bulks approximately 5 1/2 ounces by volume. Other uses of this fine powder (98 percent through 325-mesh) are as a coolant and lubricating agent in automobiles, both in the motor and in the transmission and rear end. It disperses readily in lubricating oil like graphite and is recommended by the company as a means of taking up uneven wear in automobile engines, increasing compression, and reducing oil consumption by filling the pores of metallic surfaces within the cylinders. This company obtains its raw material from Wyoming. Other properties were being developed in 1939 by the Black Hills Mining & Industrial Association in Morman Canyon near Glenrock, Wyo., and a third concern was reported to be contemplating construction of a plant near Douglas, Wyo. Vermiculite is mined by the Vermiculite Co. of America, 406 Thorpe Bldg., Minneapolis, Minn., in Colorado, and by two or more operators in North Carolina.

Production statistics for 1939 have not yet been compiled, but some increase over 1938 is anticipated. The demand in 1940 is viewed optimistically, and retail prices are firm at $1.10 to $1.35 a 24-pound bag. Prices to lumber dealers have stiffened owing to elimination of price cutting.

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